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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/675,023	09/28/2000	Richard S. Burton	60944.3300	7669

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EXAMINER

LEE, HSIEN MING

ART UNIT	PAPER NUMBER
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2823

DATE MAILED: 04/24/2002

9

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/675,023

Applicant(s)

BURTON ET AL.

Examiner

Hsien-Ming Lee

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 23 January 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-21 and 23-64 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-21 and 23-64 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other:

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## DETAILED ACTION

### *Oath/Declaration*

1. It does not identify the post office address of one of inventors, i.e. Richard S. Burton. A post office address is an address at which an inventor customarily receives his or her mail and may be either a home or business address. The post office address should include the ZIP Code designation.

### *Claim Rejections - 35 USC § 112*

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Amended claims 1, 7 and 21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Alternative limitations as recited in claims 1, 7 and 21 is unacceptable. One acceptable form of alternative expression, which is commonly referred to as a Markush group, recites members as being "selected from **the group consisting of** A, B and C." (emphasis added) See M.P.E.P. 2173.05(h)

### *Claim Rejections - 35 USC § 102*

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1, 2, 7-10, 12-13, 21, 23-25, 27-28, 34, 36, 43-48 and 61-64 are rejected under 35 U.S.C. 102(b) as being anticipated by Yanagihara et al. (US 5,523,623).

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Regarding claims 1, 7-10, 12-13, 21, 23-25, 27-28, 34, 36, 43 and 44, Yanagihara et al. identically teach the claimed method for forming an ohmic contact on a semiconductor layer comprising ( Fig.1 and related text):

- (a) depositing a reactive layer 4 comprising at least electrically conductive material on at least a portion of a compound semiconductor layer 2 ( p-type GaAs); wherein the at least electrically conductive material is a multilayer film including a Ni , a Pt and a Ti layer (col. 2, line 66 through col. 3, line 1; col. 5, lines 13-15); and
- (b) depositing a refractory layer 5 ( Ti ) comprising electrically conductive material on the reactive layer 4, wherein said refractory layer 5 is substantially free of gold.

Regarding claim 2, Yanagihara et al. also teach that the compound semiconductor can be not only p-type GaAs but also GaInAsP ( col. 8, lines 3-6).

Regarding claims 45-48, Yanagihara et al. also teach that the method would also apply to the application of a Schottky diode ( col. 1, lines 19-29; col. 7, lines 32-35) and transistor ( col. 2, lines 43-48).

Regarding claims 61-64, Yanagihara et al. also teach depositing a low sheet resistance layer such as Pt (6) onto the refractory layer 5.

### ***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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7. Claims 3-6, 11, 14-20, 26, 29-33, 35 and 37-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yanagihara et al. ( US '623) in view of Yagura et al . ( US 6,188,137 ).

Regarding claims 3-5, and 37-40, Yanagihara et al. fail to teach that the compound semiconductor layer comprises  $\text{In}_x\text{Ga}_{1-x}\text{As}$ . However,  $\text{In}_x\text{Ga}_{1-x}\text{As}$  is considered an art recognized equivalence of GaAs-based compound semiconductor, wherein the range of x can be from 0 to 1 or equals to 0.66, as evidenced by Yagura et al . (col. 4, line 12).

Therefore, it would have been obvious to an artisan at the time of the invention was made to use  $\text{In}_x\text{Ga}_{1-x}\text{As}$  as the compound semiconductor layer, wherein  $0 < x < 1$ ; or  $x = 0.66$  as taught by Yagura et al . in Yanagihara's method for forming the ohmic contact, since by doing so it would provide a satisfactory ohmic contact structure without compromising the integrity of the adjacent reactive layer.

Regarding claims 6 and 41, the examiner takes an official notice that utilizing InS as a compound semiconductor layer is a well-known practice in the field and considered an art recognized equivalence for the same purpose of  $\text{In}_x\text{Ga}_{1-x}\text{As}$ .

Regarding claims 11, 26, 35 and 42, the selection of atomic percent of an adhesive element ( such as Ti ) in the reactive layer is obvious because it is a matter of determining optimum process condition by routine experimentation. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

Regarding claims 14-18 and 29-33, the selection of the thickness of the reactive layer as well as the refractory layer is obvious because it is a matter of determining optimum process

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condition by routine experimentation. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

Regarding claims 19 and 20, the examiner takes an official notice that utilizing evaporation, reactive sputtering, nonreactive sputtering, chemical vapor deposition, electroplating and electroless plating for forming the electrically conductive material such as the reactive and refractory layers is a well-known technique in the art.

8. Claims 49-60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yanagihara et al. ( US '623) in view of Yagura et al. ( US '137 ) as applied to claims 1, 21, 36 above, and further in view of Bernhardt et al. ( US 5,583,355).

The combination of Yanagihara et al. and Yagura et al. teaches the method for forming the ohmic contact comprising depositing the reactive layer on the compound semiconductor layer and depositing the refractory layer on the reactive layer but fails to teach depositing a dielectric layer onto the refractory layer, depositing a nitride liner onto the dielectric layer and depositing a spacer onto the nitride liner.

Bernhardt et al. in an analogous art of forming an ohmic contact ( Fig.5) teach depositing a dielectric layer 17 onto the electrode 16, which is equivalent to the portion of reactive and refractory layers, depositing a nitride liner 18 onto a portion of the dielectric layer 17 and depositing a spacer 23A and 23B onto a portion of the nitride liner 18.

Therefore, an artisan at the time of the invention was made would have been motivated to deposit a desirable dielectric layer, as taught by Bernhardt et al, on the refractory layer of

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Yanagihara et al. and Yagura et al followed by depositing the nitride liner onto the dielectric layer and then a spacer onto the nitride liner, since by doing so it would protect the reactive and refractory layers from the damages of subsequent etching process during forming the ohmic contact.

***Conclusion***

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

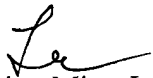
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-Ming Lee whose telephone number is 703-305-7341. The examiner can normally be reached on M-F (9:00 ~ 5:00).


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 703-308-4918. The fax phone numbers for the

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organization where this application or proceeding is assigned are 703-305-0142 for regular communications and 703-305-0142 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

  
Hsien Ming Lee  
April 17, 2002

  
LONG PHAM  
PRIMARY EXAMINER